

Behavioural observations on the Argentinian pampas deer (*Ozotoceros bezoarticus celer* Cabrera, 1943)

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Abstract

Behavioural observations are reported on the endangered Argentinian subspecies of the pampas deer (*Ozotoceros bezoarticus celer*). Data were collected between Septembers 1976 and 1979 from all four surviving populations, all located in the Pampas. Described are aspects of its maintenance, exploratory, agonistic and reproductive behaviour, play, mother-fawn relationships, and reactions to disturbance, fencelines and sympatric species. Various of the behavioural repertoires described parallel those of the North American white-tailed deer (*Odocoileus virginianus*).

Introduction

The pampas deer, *Ozotoceros bezoarticus* (= *Blastoceros bezoarticus* or *Odocoileus* [*Blastoceros*] *bezoarticus*), once abounded throughout the natural grasslands of the South American subcontinent from about 10° to 40° South. Habitat destruction, overhunting, disease and possibly competition with introduced livestock have reduced its numbers across most of the former range (JUNGUIS 1976). CABRERA (1943) distinguished three subspecies; the northern (*O. b. bezoarticus*) and central (*O. b. leucogaster*) forms figure in the indeterminate category of the Red Data Book (THORNBAC and JENKINS 1982), whereas the southernmost or Argentinian subspecies (*O. b. celer*) is recognized internationally as the most endangered deer in South America (HOLLOWAY 1975).

Apart from a preliminary study of the social behaviour of a semicaptive herd of nine *celer* (BIANCHINI and PEREZ 1972a), and another more detailed one of the captive population of *leucogaster* in West Berlin Zoo (FRÄDRICH 1981), basic behavioural components have never been described for this species.

The aim of the present study was twofold. Firstly to generate information of relevance to safeguarding surviving groups of *O. b. celer* and secondly to document the behavioural repertoire of a subspecies in imminent danger of extinction. Although studies done were not exhaustive and are still partial, it is fundamental to report any observations on endangered Cervidae that contribute to understanding their biology and are of practical conservation value (COWAN and HOLLOWAY 1973).

I carried out this work in Argentina between Septembers 1976 and 1979 in connection with the International Union for the Conservation of Nature and Natural Resources – World Wildlife Fund Project 1303.

Methods

I visited all four remaining populations of *O. b. celer* – three in the wild and one in semi-captivity. Observations were collected on foot and horseback, and from vehicles, boats and light-aircraft, depending on the locality and circumstances. In La Corona enclosure, a 6 m watch tower was

available. Data were recorded wherever and whenever practicable, irrespective of time of day or weather. A 20×60 telescope and 8×50 binoculars were used. Although intensive observation sessions were completed, visits to study areas were not always made exclusively for that purpose; vigilance, maintenance and reconnaissance were effected concurrently. Apart from individually recognizable idiosyncracies of antlers or pelage, no marked specimens existed.

Study sites

Estancia La Corona ($58^{\circ} 21'$ West; $35^{\circ} 42'$ South). In 1968/69, a 28 ha enclosure was stocked with wild-caught *O. b. celer* from the Bahía Samborombón (JACKSON 1978; JUNGIUS 1976). The deer were not actively managed or artificially fed and were shy despite being captive-bred. Numbers present fluctuated between 20–25 head. Visits were made on 105 dates and information amassed from 1516 sightings (one sighting = one animal seen on one occasion).

Bahía Samborombón ($57^{\circ} 30'$ West; $36^{\circ} 00'$ South). The barren marshland, forming the western coast of the Río de la Plata estuary, represents the last refuge of the pampas deer in Buenos Aires Province. It is a typical temperate saltmarsh ecosystem with meandering creeks and marismas with sparse grazing except on the small islets of higher ground and along watercourses. Estimated population in September 1976 was 40, distributed in several geographically isolated subgroups across 20 000 ha. Due to recent anti-poaching measures, the stock is recovering (JACKSON and LANGGUTH in press). Three hundred and twenty-five deer were watched on 166 dates.

Punta Médanos ($57^{\circ} 04'$ West; $36^{\circ} 52'$ South). At the outset, a relict group of 15 animals survived in a residual coastal sand-dune system. Subsequent land development reduced available habitat and deer numbers by half. Twenty-two visits resulted in ten sightings.

San Luis. The only other known wild *O. b. celer* population inhabits a semi-arid zone of rolling, natural tussock grassland in the central Argentinian province of San Luis. The principal concentration of 200 head in the 30 000 ha estancia "La Travesía" ($66^{\circ} 00'$ West; $34^{\circ} 22'$ South) were studied for twenty-one days and 197 deer observations made.

Results and discussion

Maintenance behaviour

When undisturbed, pampas deer often stayed on the feeding grounds to cud and rest, with a minimum spacing of 2 m between group members. Commonly, one individual remained standing or feeding nearby a resting herd. They utilized protected bedding sites during inclement weather, constant usage of which created well-marked "beds". During cold weather, resting places provided shelter from the prevailing wind and access to solar warmth. High temperatures and biting insects forced deer to seek shade. Considerable aggressive competition occurred for preferred sites.

When deer approached a resting place, they frequently scraped the ground with the forefoot before bedding. Once settled, they usually faced the direction from which they had come. The pungent smell typical of this species (DARWIN 1839; ROOSEVELT 1914) lingered at favoured resting sites.

Pampas deer never relaxed in the dog-like stance of taruca (*Hippocamelus antisensis*) (ROSE and REES 1976) but instead favoured typical cervid poses. While standing, animals dozed for up to 60 s and slept laying down for a maximum of 180 s with the head held back across their flanks. Deer ruminated whilst standing but normally cuddled whilst recumbent.

Upon rising, they tended to defecate near the bedding site, curling the tail up and over the back to reveal the white underside and anal areas. They voided droppings at intervals throughout the day, normally in well-defined groups.

Extensive self-grooming occurred. The hindleg served to scratch parts inaccessible to the tongue. On rising, they sometimes arched the back similar to mule deer (*Odocoileus hemionus*) (GEIST 1966), stretched like canids, yawned, or shook vigorously when wet.

The normal urination stance was with the hind legs spread apart and a slight squat in males and a deeper one in females. Although pampas deer possess well-formed tarsal gland (LANGGUTH and JACKSON 1980; MACDONAGH 1940), the habit of rub-urinating (GEIST 1966; HIRTH 1977; MÜLLER-SCHWARZE 1971) was not observed.

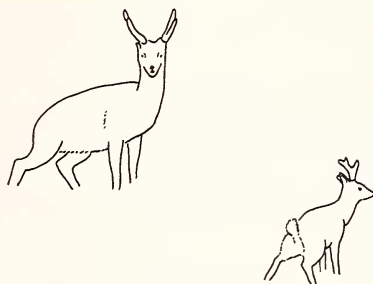


Fig. 1. Male pampas deer,
Ozotoceros bezoarticus celer,
in urinating stance

Shortly after dawn, individuals often stood still with the eyes half-shut for up to 300 s, reorientating themselves to get the maximum benefit of the sun's early rays. Sunbathing occurred in all classes of deer but prevailed amongst older specimens.

Deer commonly travelled in file. In mixed groups, dominant does preceded subordinates, then followed subadult and adult bucks; fawns came after their dams.

Pampas deer fed at intervals during the day. They were selective grazers, seeking out new green growth and also taking forbs and seed heads of tall grasses. During droughts, they dug out roots with the forefoot.

O. b. celer were curious and confiding, quickly coming to investigate new objects or to watch men at work. A well-tried poaching method was to erect and hide near a flag, ready to shoot the deer when they approached to explore the new phenomenon. Such exploratory behaviour could be capitalized on by scientists wishing to attract this subspecies for observation, census or capture purposes. Similarly it implies that special antipoaching vigilance of workers is desirable as the deer do not always flee from their presence as might be expected.

Alarm reactions

The reactions of *O. b. celer* were recorded to a wide range of disturbances. The response elicited depended on the type, intensity and proximity of the danger but a general sequence could be identified.

Mild disturbance caused deer to stare, getting up if resting, and to adopt an upright stance. The head was directed towards the danger, the ears moved and the nose raised with the nostrils flared, testing the air. Maintenance of this posture optimized the receipt of visual, olfactory and auditory information, and when adopted in excess of ten seconds alerted other herd members. When the stimulus was visual yet partially obscured, deer peered to obtain a clearer view.

If the danger was distant, and not immediately identifiable, the animal walked a few paces and stamped with either forefoot. Both sexes uttered short, explosive snorts by expelling air through the nostrils. They alternated between turning the body broadside to the source of disturbance and then rotating to face it. This behaviour alerted conspecifics. Mild piloerection was sometimes visible.

The next progression was to stilting, a slow exaggerated walk with the legs lifted high and the hooves smacked onto the ground. The body-turning tendency persisted as did snorting and testing the air. The tail was raised in proportion to the display's intensity, and in its most pronounced form was curled and flared up and over the back to reveal the white underside.

These three reactions interphased and were often accompanied by herd members defecating or urinating.

Deer fled with a characteristic stiff-legged mechanical run with the tails raised up and over the back. The tail was not actively waved or flagged as in white-tailed deer, but the exaggerated swagging gait wobbled it, drawing further attention to this sign stimulus.

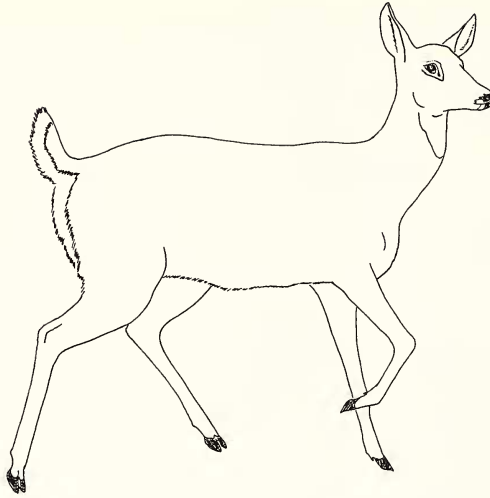


Fig. 2. Female pampas deer,
Ozotoceros bezoarticus celer,
showing stilted alarm gait

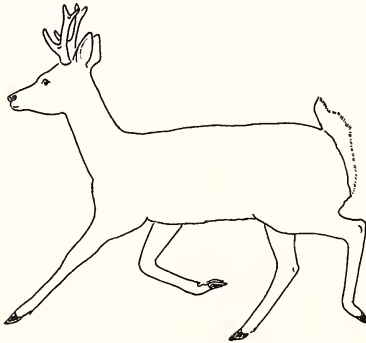


Fig. 3. Buck pampas deer,
Ozotoceros bezoarticus celer,
illustrating stiff-legged run

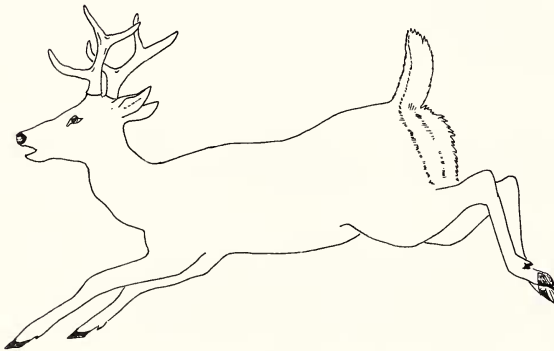


Fig. 4. Male pampas deer,
Ozotoceros bezoarticus celer,
bounding

They used this form of locomotion to cross open ground, and if the danger was not too close, forming a rough file. In mixed fleeing groups, does led followed by their respective fawns, with young males and lastly adult bucks at the rear.

In critical situations, or when fleeing in tussock grassland, the gallop or bound was preferred, again with the tailed flared over the rump. They sometimes escaped in line, but

since this gait was usually used when disturbed at close quarters, the tendency was to disperse in all directions with minimal group cohesion.

On bolting, animals often gave a short, sharp whistle, a more forceful expulsion of air than snorting. The strong odour of this species persisted at the site and was probably deposited from the rear interdigital glands during stamping or when the hind cleaves opened to give traction on fleeing (LANGGUTH and JACKSON 1981).

Pampas deer were never seen to stot or pronk as other ungulates do (DAGG 1973).

The reactions of this species to disturbance closely parallels that described for white-tailed deer (THOMAS et al. 1965).

When danger appeared suddenly and very close, and deer were in cover, or when it was distant and they were already well concealed, animals avoided detection either by freezing if on foot, or by laying prostrate if recumbent. Neonates remained absolutely motionless, with the ears back, relying on their dappled pelage to escape notice. Three different lone does fled at a gallop but with the heads and tails down. Twice, mature females surprised in rank grassland attempted to crawl or slink away undetected.

WHITEHEAD and ANCHORENA (1972) stated that pampas deer try to avoid detection in the open by freezing too but I never noted this trait. Once a buck bolted, ran 40 m to where another laid concealed and ousted it, the second fleeing and the first occupying the others refuge.

As DARWIN noted (1839), deer were nervous of mounted horses even in places where they were not persecuted and saw riders daily. Their reaction to people on foot depended on the local degree of poaching. The easiest way to approach deer was in a slow-moving vehicle. They took little notice of spotting planes flying above 50 m, but fled into cover during low-level runs.

Reactions to fencelines

Large-scale land enclosure commenced in the Pampas during the late 1800s, since when a universal network of seven-strand high-tensile wire fences has dissected the region. These barriers could have disrupted the native ungulates behavioural patterns, thereby accelerating the population decline. Pampas deer were observed crossing fencelines only twice, both times adults passing with great difficulty through the central wires. Whereas other deer species prefer to go under fences, often utilizing irregularities of terrain to form passes, I could find no evidence that pampas deer adopted such tactics. All individuals spotted adjacent to fences were markedly over-excited.

In La Corona enclosure, young fawns twice bolted into the boundary fence, and trials with a fixed-position, low, two-strand electric fence were abandoned after a month since deer constantly collided with it.

Since pampas deer did not easily negotiate present fence styles, modified structures or passes such as those used in North America on pronghorn antelope (*Antilocapra americana*) range (YOAKUM et al. 1980) were proposed as a conservation measure.

Social behaviour

Even when formerly numerous, *celer* lived in small mixed groups, rarely exceeding five or six animals (CABRERA and YEPES 1940; DARWIN 1839). They continue to do so today (JACKSON and LANGGUTH in press). Larger aggregations occasionally formed on common feeding grounds such as burnt areas but were loose temporal associations in which distinguishable social subgroups existed.

Wild herds appeared fluid in size and composition. Individuals, notably adult bucks, were observed to move freely between groups at any season. Mature males mixed with does yearlong. No evidence existed of habitat repartition by sex or age. BIANCHINI and PEREZ (1972a) reported home range and territory formation in the semi-captive *celer*

population at La Corona but supplied few other details. This aspect of behaviour could not be adequately investigated in the actual study.

Contact

Mutual grooming was frequently watched between females and their offspring and once between non-equal antlered bucks. Grooming sessions lasted from 5 to 150 s. Attention was directed to the neck region and was preceded by the pairs touching noses.

This act was seen when an arriving animal approached another already feeding or resting, and they raised heads to touch noses or nasal areas for several seconds. Mutual grooming often followed and the newcomer stayed with its conspecifics. This naso-nasal greeting occurred between females:fawns, bucks:fawns, and adults of the same and different sex and social ranking.

Pampas deer have a paired sebaceous gland in the vestibulum nasi. A flattened oval sac, some 15 by 25 mm, lies on either side of the nose, beneath the skin on the border between the white muzzle and the darker adjoining hair. Each sac opens via a short single duct onto the rim of its respective nostril. The contrasting colour pattern focusses attention on the area overlaying the glands which in *Ozotoceros* play a role in greeting or individual recognition (LANGGUTH and JACKSON 1980).

Similar behaviour was reported by GEIST (1963) in moose (*Alces alces*), who termed it naso-nasal testing, and in white-tailed deer by HIRTH (1977).

Once, an adult male approached a recumbent doe, sniffing her forehead intently for five seconds before moving off. The significance of this act was uncertain but the region might be glandular as in roe (*Capreolus capreolus*) (SCHUMACHER 1936; KURT 1968), mule (MÜLLER-SCHWARZE 1971; QUAY and MÜLLER-SCHWARZE 1970) and white-tailed deer (ATKENSON and MARCHINTON 1982; HIRTH 1977).

Maternal

After a seven month gestation (FRÄDRICH 1981), pampas deer bear a single dappled fawn. In *celer*, births occur yearlong but are concentrated in spring (JACKSON and LANGGUTH in press).

Parturition was never witnessed. Does with newborn were secretive, solitary and rested away from their young. Mothers seldom approached hidden offspring directly but by a roundabout route, mock-feeding, constantly alert and testing the wind. Fawns suckled for periods of 10 to 180 s in a reverse parallel position, sometimes with the tail curled up and flared. FRÄDRICH (1981) described how in West Berlin Zoo day-old fawns drank from the reclining mother and that the young suckled regularly for about four months.

Mother either nuzzled or licked the offspring's anal area to stimulate defecation and sometimes voided droppings themselves. Does groomed fawns extensively. One young stood beneath its dam, rubbing its back vigorously against her chest and belly.

Fawns first ingested plant material when 4 to 6 weeks of age; they also consumed quantities of soil. By two months of age, they regularly grazed with the mother and other deer, but still tended to bed separately. Fawns uttered a bleat-like call, apparently as an indication of distress. This was only heard when a young animal became separated from the doe and elicited a searching response by her.

Mothers actively defended young against predators. Defence of neonates by the female was observed seven times, on five occasions towards humans, once towards a feral cat and once against a grey fox (*Duscicyon gymnocercus*). The does stamped the forefeet, as in the alarm sequence, and stood their ground to these potential predators when about 15 m from the hidden offspring. When observers were 30 m from fawns, dams began circling the area, feigning feeding. On closer approach, the females tried to draw attention away or buzzed

the man, repeatedly running close to him in the head stretched aggressive pose. One doe attacked physically, rushing at the author from behind to barge with the shoulder and butt with her head against his legs.

BIANCHINI and PEREZ (1972a) and FRÄDRICH (1981) reported similar protective maternal behaviour in this species.

Play

This was witnessed six times. On three occasions, young fawns gamboled in wide circles around their mother or static objects, making sudden changes in direction. Two does and a fawn pursued one another in a form of tag in which the order changed frequently. A young antlered male chased pigeons (*Columba livia*) for five minutes, trotting towards the flock which then scattered to resettle nearby. This was repeated four times before they finally flew off. A fawn acted similarly with a group of hares (*Lepus capensis*). Animals also sometimes ran haphazardly, shaking their heads in a beserk manner because of mosquitoes, tabanids and bot flies. FRÄDRICH (1981) described various forms of play. During running games, his fawns held the tail upright which was not the case in the few observations I made.

Agonistic behaviour

Various intergrading aggressive actions were distinguished, each posture conveying a different level of hostile intent. Without marked animals, it was hard to study leadership or dominance, but a definite social hierarchy existed, maintained by aggressive-submissive encounters, although no quantitative data could be collected to substantiate this.

Glare

The aggressor stood with the neck erect, head drawn back and chin pulled in, and stared directly at the adversary. Occasionally the ears were dropped flat along the neck. This low-intensity posture was probably employed more frequently than realised, often only being evident after the second animal responded submissively.

Head low threat and chase

In the commonest observed form of aggression, the head and the neck were lowered towards the adversary, with the ears back as in the glare. This posture was accompanied by a short chase. This action corresponds to the "hard look" of white-tails (THOMAS et al. 1965).

Strike and barge

An adult doe struck an yearling female a single hard blow with the forefoot on the shoulder when the other crossed directly in front of her whilst grazing. One mature female intentionally barged another, hitting her a tangential blow in the left rump with the left shoulder. The aggressee retreated in a submissive trot. Rearing or flailing were never noted although a hand-reared animal boxed with its owner, standing on its hind legs and slashing with the forefeet.

Antler present threat

Males nodded their heads, with the ears back and dropped, to present their antlers to non-antlered deer which reacted submissively. Subordinate bucks in hard rack also moved away unless this gesture comprised part of sparring. Twice does threatened unrelated fawns by a mock butt, analogous to the antler present threat.

Submission

When aggression was of low intensity, the subordinate changed activity by looking away, reflexed the ears back and up, or turned its head to expose the neck, often also commencing self-grooming or feigning grazing. Aggressees normally fled with the ears back, head lowered and tail tucked under in response to serious agonistic threats.

FRÄDRICH (1981) noted footstamping, striking with the forefoot, and head-low and antler present threats as common forms of aggression amongst captive *leucogaster*. Also described were a circling, goose-stepping gait, nudging with the snout, pseudobiting, and rearing or flailing. Submissive subadults of both sexes and adult does sometimes suddenly laid down, and stretched the neck and head out in front, repeatedly placing the neck on the ground (FRÄDRICH 1981). I never saw this in *O. b. celer*, possibly because behavioural differences may exist between cervid subspecies (COWAN and GEIST 1961), or because agonistic acts occur more frequently and with greater complexity under zoo conditions than in the low density populations of *celer* studied.

Reproductive behaviour

In the Pampas region, this species is a seasonal breeder. The majority of fawns are spring-born. A synchronized antler cycle exists. Antlers are shed in mid winter, regrowth starts immediately and racks are clean by early summer. Rutting activity is concentrated in, but is not exclusive to, late summer and autumn (JACKSON and LANGGUTH in press). The following types of reproductive behaviour were observed.

Antler rubbing and thrashing

This was studied 22 times. Twice, bucks with antlers fully grown yet still in velvet, lightly thrashed clumps of dry grass, an action distinct from the rubbing used to accelerate shedding of dried velvet. Males in hard rack thrashed grass or reed tussocks and small shrubs. Bucks with antlers festooned with vegetation were seen occasionally. More intense displays involved them rubbing the antler bases or coronets and forehead on vegetation, but only once was the suborbital gland region employed too. The most frenzied exhibitions were characterized by scraping the ground with the forefoot, accompanied by urinating, curling the tail up and over the back, and rarely by defecation too.

Scraping was mentioned by BIANCHINI and PEREZ (1972a) and thrashing and scraping with urination by FRÄDRICH (1981). He also reported that in *leucogaster*, the tail may be obliquely raised and moved quickly from side to side.

Sparring and fighting

This was frequent between all classes of bucks in the prerut. Non-equal animals often sparred and contests were commonly initiated by young males against mature ones. A behavioural sequence existed but was seldom adhered to. The aggressor approached a rival, nosetouching occurred and the antler present threat was given. They might then touch the tips of the antler tines gently before locking antlers to push back and forth, twisting and turning for up to 180 s. After sparring bouts ended, vanquished animals were not pursued and often challenged the same or nearby bucks.

Three pairs of males in velvet touched noses and antler tips before halting and resuming other activities. On three distinct opportunities, after giving the antler present threat, pairs of hard-antlered animals did not engage but turned to walk slowly parallel in an upright stance for 10 to 30 m, at a distance of one metre apart; twice they then refaced one another, presented antlers and sparred whilst the other time they simply moved apart. This

behaviour is not analagous to the "sidle" where white-tails approach one another broad-side (THOMAS et al. 1965).

When an invitation to spar was not accepted, aggressors might gently prod the other with the antlers in the face or shoulder to stimulate an engagement.

The distinction between sparring and fighting was a fine one. Vigorous encounters were witnessed between equal bucks and were characterized by their ferocity and by the winner pursuing the loser a short distance.

Young bucks sometimes practised mock fights alone, lowering their antlers towards large isolated grass tussocks, twisting and turning their bodies yet scarcely moving the head as if locked in combat. This displacement activity was quite distinct from thrashing and no contact was made with the vegetation.

Courtship

There was no evidence of territorial reproductive behaviour or harem formation in this race. Up to three bucks harried a receptive doe. Males approached oestrous females with the head and neck lowered, chin slightly raised and ears back. This posture resembled the head-low threat but was slower with a higher stance. If the doe did not flee, the buck neared at a walk and followed her, attempting to scent or lick the vulva. Bucks showed nostril dilation, flehmen and licked the nose. Responsive does were pursued in courtship chases over several hundred metres. Dominant males followed females closely, sporadically turning to threaten pursuing subordinates. Does never urinated during chases.

Neither attempted mounting, copulation nor post-copulatory acts were seen. Males in velvet also courted oestrous does outside the peak rutting season. No vocalization was heard, but low, faint sounds could easily be missed. Pampas deer did not dig rutting pits or wallow.

These observations are similar to those of FRÄDRICH (1981) except that he noted urination during courtship.

Interspecific relations

BIANCHINI and PEREZ (1972b) state that pampas deer never mix or associate with livestock, inferring that introduction of domestic animals displaced the native cervid into suboptimal habitats, of low grazing value, thus contributing to its near extinction. In contrast, my findings were that deer took little notice of other ungulates and vice versa. They regularly grazed close to cattle and horses and bedded near bovids in thorn scrub in San Luis. Occasional deer there were reported living with flocks of sheep and goats. Only in the Bahía Samborombón, where grazing was confined to islets and copses, did *celer* appear to avoid feral pigs. Deer fed close to European hares and to ñandú (*Rhea americana*). Competition by exclusion is not an important limiting factor between pampas deer and the sympatric species mentioned here.

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Zusammenfassung

Verhaltensbeobachtungen am argentinischen Pampashirsch
(*Ozotoceros bezoarticus celer* Cabrera, 1943)

An allen vier noch in der Pampa vorhandenen Populationen der bedrohten argentinischen Unterart des Pampashirsches (*Ozotoceros bezoarticus celer* Cabrera, 1943) wurden von September 1976 bis 1979

Verhaltensbeobachtungen angestellt. Sie befassen sich mit Aspekten des Managements, des Erkundungs-, Kampf- und Fortpflanzungsverhaltens sowie mit dem Spiel, den Mutter-Kind-Beziehungen und Reaktionen auf Störungen, Einzäunungen und Begegnungen mit anderen Tierarten.

References

- ATKESON, T. D.; MARCHINGTON, R. L. (1982): Forehead glands in white-tailed deer. *J. Mammalogy* **63**, 613–617.
- BIANCHINI, J. J.; PEREZ, J. C. L. (1972a): El comportamiento de *Ozotoceros bezoarticus celer* Cabrera en cautiverio. *Acta zoológica Lillioana* **39**, 5–16.
- (1972b): Informe sobre la situación del ciervo de las pampas – *Ozotoceros bezoarticus celer* Cabrera, 1943 – en la Provincia de Buenos Aires. *Acta zoológica Lillioana* **39**, 149–157.
- CABRERA, A. (1943): Sobre la sistemática del venado y su variación individual y geográfica. *Rev. Mus. La Plata (N. S.)* **3**, 5–41.
- CABRERA, A.; YEPES, J. (1960): Los mamíferos sudamericanos. Buenos Aires: Ediar.
- COWAN, I. McT.; GEIST, V. (1961): Aggressive behavior in deer of the genus *Odocoileus*. *J. Mammalogy* **42**, 522–526.
- COWAN, I. McT.; HOLLOWAY, C. W. (1973): Threatened deer of the World: conservation status. *Biol. Conserv.* **5**, 243–250.
- DAGG, A. I. (1973): Gaits in mammals. *Mammal Rev.* **3**, 135–154.
- DARWIN, C. (1839): Narrative of the surveying voyages of His Majesty's ships Adventure and Beagle, between the years 1826 and 1836, describing their examination of the southern shores of South America, and the Beagle's circumnavigation of the globe. London: Henry Colburn.
- FRÄDRICH, H. (1981): Beobachtungen am Pampashirsch, *Blastocercus bezoarticus* (L., 1758). *Zool. Garten N. F.* **51**, 7–32.
- GEIST, V. (1963): On the behavior of the North American moose (*Alces alces andersoni* Peterson, 1950) in British Columbia. *Behaviour* **20**, 377–416.
- (1966): Ethological observations on some North American cervids. *Zool. Beiträge* **12**, 219–250.
- HIRTH, D. H. (1977): Social behavior of white-tailed deer in relation to habitat. *Wildl. Monogr.* **53**, 1–55.
- HOLLOWAY, C. W. (1975): Threatened deer of the World: research and conservation projects under the IUCN programme. *Deer* **3**, 428–433.
- JACKSON, J. (1978): The Argentinian pampas deer or venado (*Ozotoceros bezoarticus celer*). In: Threatened Deer. Morges: IUCN Publications. Pp 33–45.
- JACKSON, J. E.; LANGGUTH, A. (1984): Ecology and status of the pampas deer in the Argentinian Pampas and Uruguay. In: Biology and Management of the Cervidae. Ed. by C. WEMMER. Washington: Smithsonian Institute (in press).
- JUNGUIS, H. (1976): Status and distribution of threatened deer species in South America. In: World Wildlife Yearbook 1975–76. Ed. by P. JACKSON. Morges: World Wildlife Fund. Pp 203–217.
- KURT, F. (1968): Das Sozialverhalten des Rehes *Capreolus capreolus* L. Eine Feldstudie. *Mammalia depicta*. Hamburg and Berlin: Paul Parey.
- LANGGUTH, A.; JACKSON, J. (1980): Cutaneous scent glands in pampas deer *Blastocercus bezoarticus* (L., 1758). *Z. Säugetierkunde* **45**, 82–90.
- MACDONAGH, E. J. (1940): La etología del venado en el Tuyú. *Notas Mus. La Plata* **5**, 47–68.
- MÜLLER-SCHWARZE, D. (1971): Pheromones in black-tailed deer (*Odocoileus hemionus columbianus*). *Anim. Behav.* **19**, 141–152.
- QUAY, W. B.; MÜLLER-SCHWARZE, D. (1970): Functional histology of integumentary glandular regions in black-tailed deer (*Odocoileus hemionus columbianus*). *J. Mammalogy* **51**, 675–694.
- ROE, N. A.; REES, W. E. (1976): Preliminary observations of the taruca (*Hippocamelus antisensis*: Cervidae) in Southern Peru. *J. Mammalogy* **57**, 722–730.
- ROOSEVELT, T. (1914): Through the Brazilian wilderness. London: John Murray.
- SCHUMACHER, S. (1936): Das Stirnorgan des Rehbockes (*Capreolus capreolus capreolus* L.), ein bisher unbekanntes Duftorgan. *Z. mikr. anat. Forsch.* **39**, 215–230.
- THOMAS, J. W.; ROBINSON, R. M.; MARBURGER, R. G. (1965): Social behavior in a white-tailed deer containing hypogonadal males. *J. Mammalogy* **46**, 314–327.
- THORNBACH, J.; JENKINS, M. (1982). The IUCN mammal red data book, part 1. Gland, IUCN.
- WHITEHEAD, G. K.; ANCHORENA, M. de (1972): Operation pampas deer. *Country Life* **596**.
- YOAKUM, J.; DASMANN, W. P.; SANDERSON, H. R.; NIXON, C. M.; CRAWFORD, H. S. (1980): Habitat improvement techniques. In: Wildlife Management Techniques Manual. Ed. by S. D. SCHEMNITZ. Washington: The Wildlife Society. Pp 329–404.

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